THE SEASONAL OCCURRENCE OF *AMBLYOMMA TRIGUTTATUM TRIGUTTATUM* KOCH (ACARI : IXODIDAE)

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TICKS
SEASONALITY
AUSTRALIA

SUMMARY : The seasonality of *Amblyomma triguttatum triguttatum* was investigated using carbon dioxide traps set up in Durikai State Forest, Queensland, Australia, and by counting the number of the different tick stages found on the ears of *Macropus giganteus*.

Larvae of *A. t. triguttatum* were found from March to September ; they were more abundant in March-April. Nymphs were detected from March to December with the peak number during August. Adult ticks were found from November to March with the maximum number in December-January. The sequence of the peak numbers of the different tick stages substantiates the assumption that a single generation of *A. t. triguttatum* is produced yearly.

A forested habitat supported a larger tick population than an adjacent open pasture. One hundred seventy-seven (69 %) of the 258 *M. giganteus* ears were infested with *A. t. triguttatum* which was the only tick species found on them. Larvae, nymphs adults of *Haemaphysalis bancrofti* were also caught in the traps set up in the forested habitat.

GARRAPATAS
ESTACIONALIDAD
AUSTRALIA

RESUMEN : Se investigó la estacionalidad de *Amblyomma triguttatum triguttatum* utilizando trampas de anhidrido carbónico en Durikai Forest, Queensland, Australia y contando los diferentes estadios de esta garrapata presentes sobre las orejas de *Macropus giganteus*.

Las larvas de *A. t. triguttatum* se detectaroń de marzo a setiembre ; éstas fueron más abundantes en marzo-abril. Se encontraroń ninfas desde marzo a diciembre con número pico en agosto. Garrapatas adultas fueron encontradas desde noviembre a marzo con el pico de abundancia en diciembre-enero. La secuencia de los picos de abundancia de los diferentes estadios substancia la presunción que se produce una sola generación anual de *A. t. triguttatum*.

Un habitat forestado soportó una mayor población de garrapatas que una pradera adyacente. Ciento setenta y siete (69 %) de las 258 orejas de *M. giganteus* estaban infestadas con *A. t. triguttatum*, que fue la única especie de garrapatas encontradas sobre ellas. Larvas, ninfas y adultos de *Haemaphysalis bancrofti* fueron también detectadas en las trampas dispuestas en el habitat forestado.

TIQUES
ACTIVITÉ
SAISONNIÈRE
AUSTRALIE

RÉSUMÉ : L'activité saisonnière d'*Amblyomma triguttatum triguttatum* a été recherchée au moyen de trappes au gaz carbonique placées dans la forêt de l'État de Durikai, au Queensland, en Australie, et en faisant le décompte des différents stades de la tique sur les oreilles de *Macropus giganteus*.

Les larves d'*A. t. triguttatum* ont été trouvées de mars à septembre ; elles étaient le plus abondant en mars-avril. Les nymphes ont été détectées de mars à décembre,

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avec un acmée en août. Les adultes ont été trouvés de novembre à mars, avec un maximum numérique en décembre-janvier. La séquence des optima de présence des différents stades de la tique rend substancielle l'affirmatin qu'une seule génération d'*A. t. triguttatum* est produite annuellement.

L'habitat forestier entretient une plus grande population de la tique que le pâturage ouver adjacent. Cent soixante dix-sept (69 %) des 258 oreilles du *M. giganteus* étaient parasitées par *A. t. triguttatum* qui fut la seule espèce de tique trouvée sur lui. Les larves, les nymphes et les adultes d'*Haemaphysalis bancrofti* ont été capturés aussi dans les trappes placées en habitat forestier.

Introduction

Amblyomma triguttatum triguttatum is a three-host tick peculiar to Australia ; the natural hosts for all parasitic stages are the larger macropods, although it also attaches to and feeds from various mammals, including man (Roberts, 1970). It is involved in the epidemiology of Q fever in western Queensland (Pope *et al.*, 1960) and the larvae cause an allergic dermatitis in man (Moorhouse, 1981). The reproductive behaviour of *A. t. triguttatum* appears to be more primitive. This situation is intermediate between Prostriatan and Metastriatan ticks (Guglielmone *et al.*). Unfed *A. t. triguttatum* males can inseminate unfed females off the host but copulation under natural conditions is apparently dependant on the presence of hosts (Guglielmone and Moorhouse, 1983, 1986a).

A. t. triguttatum is widely distributed in inland areas of eastern Australia (Roberts, 1962) where its seasonality appears to be governed by nymphal diapause (Guglielmone and Moorhouse, 1986b). However, information on the seasonal distribution of this tick species is scanty. Roberts (1962, 1970) stated that adults were more abundant during the summer, and Derrick *et al.* (1959) found that nymphs become more numerous in August and September. This article refers to the abundance and seasonality of the larvae, nymphs and adults of *A. t. triguttatum* in two adjacent habitats and on one of its common hosts, the grey kangaroo (*Macropus giganteus*).

Materials and methods

Seasonal incidence of host-seeking stages

The study site was located in Durikai State Forest (28°12′ S 151°39′ E), Queensland, Australia, where natural hosts of *A. t. triguttatum* are common and suffer minimal human disturbance. Hill (1981) described the vegetation of this site.

	Larvae	Nymphs	Adults	
			♂♂	♀♀
Forest	313	326	31	45
Open area	62	82	4	3

Table 1. — Total number of larvae, nymphs and adults of *Amblyomma triguttatum triguttatum* caught in a forested habitat and in an adjacent open area from July 1982 to June 1983.

The sampling of ticks was carried out in a forested habitat from July 1981 to June 1983 and in an adjacent open area from July 1982 to June 1983. Carbon dioxide baited traps, as described by Guglielmone *et al.* (1985), were used to sample the environment for host-seeking tick stages since this technique was more efficient to trap nymphs and adults of *A. t. triguttatum* than dragging, and no difference was found to trap larvae. Ten traps were set up monthly in each habitat for two hours, from 0800-0900 to 1000-1100 pm. Different spots were sampled each month.

Seasonal incidence on grey Kangaroos

Seasonal incidence was studied by counting the ticks found on the ears of *M. giganteus*, since more than 90 % of larvae and nymphs, and 79 % of adults of *A. t. triguttatum* were found on the ears of *M. giganteus* (Guglielmone, 1990). The ears (one per kangaroo) were from adults shot for commercial purposes by professional hunters in sites whose latitude ranged from 24°25′ to 28°16′ S and whose longitude varied from 145°28′ to 148°48′ E. The ears were obtained *via* the personnel of the Wildlife Division, Queensland Department of Primary Industries (Hermitage Research Station, Warwick).

The study was designed to cover the period July 1982-June 1983 but no material was obtained in February, May and June. The number of ears inspected monthly are indicated in Table 2.

Month	N° of ears	Tick stage Larva		Nymph		Adult	
		I*	%	I	%	I	%
Jul 1982	10	7	70	10	100	0	0
Aug	28	15	54	27	96	0	0
Sep	30	8	27	30	100	0	0
Oct	29	0	0	27	93	0	0
Nov	38	0	0	23	61	3	8
Dec	30	0	0	1	3	8	27
Jan 1983	47	0	0	0	0	16	34
Feb				no data			
Mar	30	20	67	3	10	5	17
Apr	16	14	88	5	31	0	0
May				no data			
Jun				no data			
Total	258	64	25	126	49	32	12

* N° of ears infested.

TABLE 2. — Number and percentage of ears from *Macropus giganteus* found infested with *Amblyomma triguttatum triguttatum* monthly.

Metereological data

The monthly rainfall and the mean monthly minimum and maximum temperatures of Warwick (28°12′ S 152°06′ E), where the closest Metereological Station to Durikai State Forest is located, Blackall (24°25′ S 145°28′ E) and Cunnamulla (28°16′ S 145°49′ E) were obtained from the Queensland Bureau of Metereology. The data are presented in Fig. 1.

RESULTS

The seasonal distribution of the larvae, nymphs and adults of *A. t. triguttatum* are shown in Fig. 2. Larvae were detected from March to September with peak numbers in March (open area and kangaroos) and April (forest). Nymphs were found from March (kangaroos), April (forest) to December, and from May to November in the open pasture with peaks of abundance in August. The

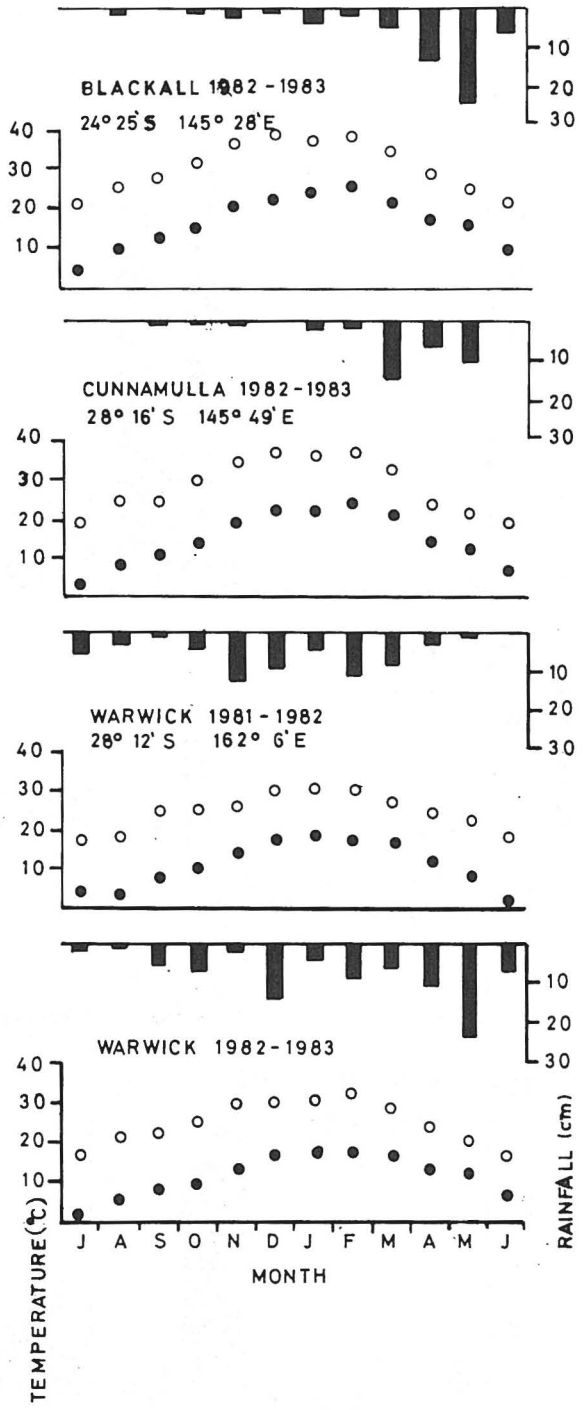

FIG 1 : Maximum and minimum mean temperatures and rainfall at the extremes of the range of the area of study of *Amblyomma triguttatum triguttatum* seasonal occurrence. *Warwick (28°12′ S 152°06′ E) is the closest locality to Durikai State Forest (28°12′ S 151°39′ E) with a Metereological Sation.

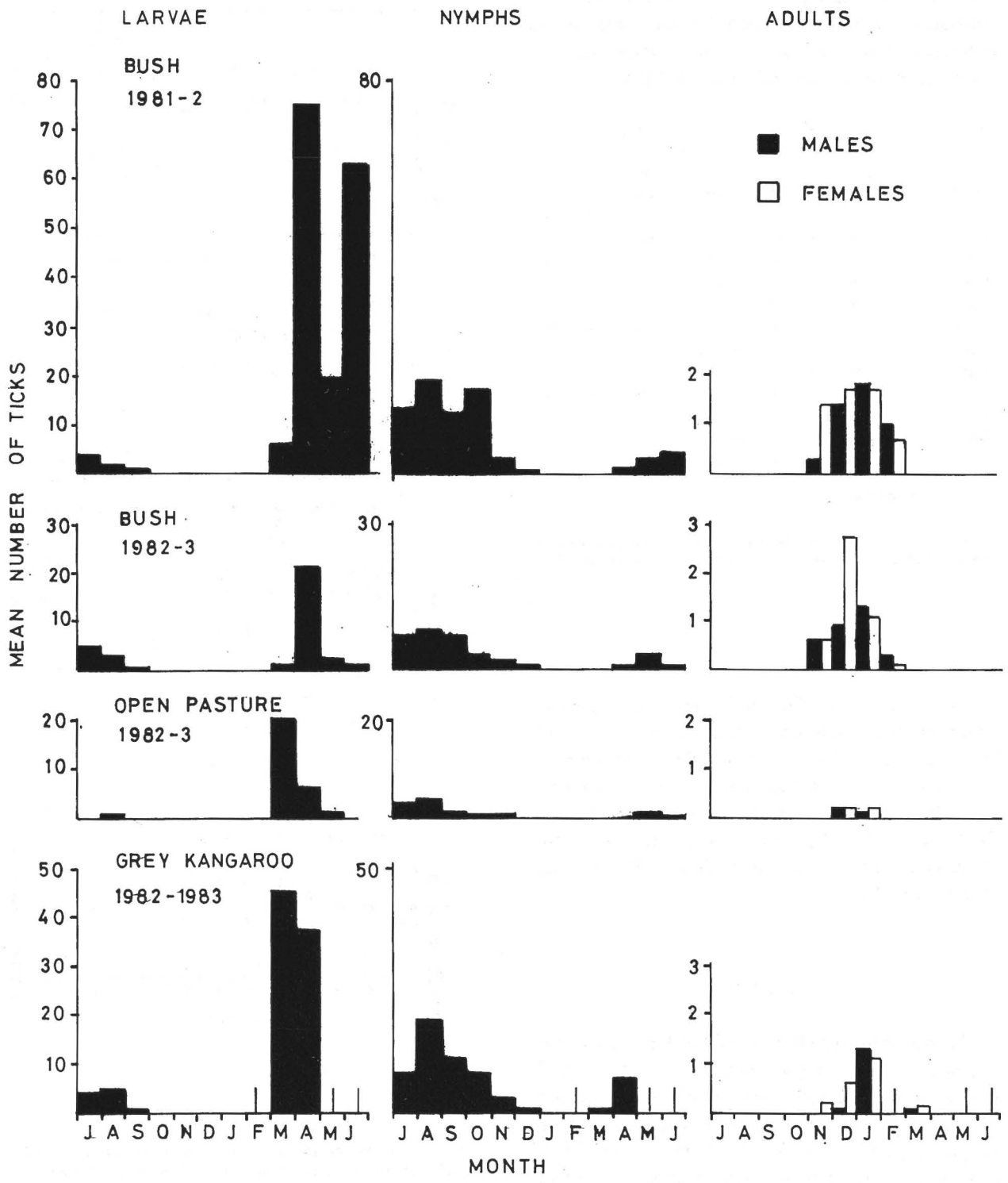

FIG. 2 : Seasonal occurrence of larvae, nymphs and adults *Amblyomma triguttatum triguttatum* in two habitats and one natural host. Vertical lines indicates no data.

highest number of adult ticks were registered in December-January; they were detected from November to February (forest) or March (kangaroos) and only during December and January in the open pasture. Host-seeking tick stages were more abundant in the forested than in the open area (Table 1).

Twenty-five larvae, 34 nymphs, 12 males and 11 females of *Haemaphysalis bancrofti* were also caught in the carbon dioxide traps set up in the forest. The adults of this tick species were detected from October to February, whereas 33 of the nymphs were found from June to December ; all the larvae were caught in April.

One hundred seventy-seven (69 %) of the 258 *M. giganteus* ears studied were infested with *A. t. triguttatum* which was the only species of ticks found on them. The number and percentage of the ears infested with the different tick stages are presented in Table 2. The highest infestation of an ear with larvae, nymphs and adults of *A. t. triguttatum* were of 930 (March), 81 (August) and 50 (40 males, 10 females, January), respectively.

Discussion

The sequential abundance of the different instars of *A. t. triguttatum* substantiates the assumption that only one generation is produced each year. Adult ticks were found from November to March, however Robert (1962) found adults of *A. t. triguttatum* all year round, albeit only in small numbers apart from the summer months. One of his findings was made within the geographical range of the present study (6 females, horse, 17 June 1909, Aughatella, 25°48′ S 146°35′ E) ; nevertheless the inspection of 49 ears of kangaroos caught from May to October around Zughatella showed the presence of only larvae and nymphs. Moreover Guglielmone (1990), studying the attachment sites of *A. t. triguttatum* on 146 feral pigs and 88 grey kangaroos in southeast Queensland (26°39′ to 28°35′ S and 148°14′ to 150°18′ E) failed to detect any adult of *A. t. triguttatum* outside the summer. The females of *A. t. triguttatum* can attach to a host in the absence of males and they remain on it for long periods of time unless they copulate (Guglielmone and Moorhouse, 1983) ; this biological feature may explain some of the findings of *A. t. triguttatum* females on hosts in an unusual season.

The timing of adult tick activity followed by larval peak showed that the bulk of the eggs were laid during the summer and developed to larvae in summer-early autum. Eggs are the most susceptible stage of *A. t. triguttatum* to high saturation deficit of water (Guglielmone, in press) which occurs in sites as Blackall and Cunnamulla due to the conjunction of high temperature and low rainfall in summer. Nevertheless the eggs were able to overcome water deficit judged by the peak of larval activity during March. Probably *A. t. triguttatum* engorged females select the most approriate microenvironment to lay their eggs, as could be under forest debris.

The seasonal activity of the larvae seems to be favoured by decreasing temperature and, in turn, lower saturation deficit occuring from March since the longevity is short when the saturation deficit is high (Guglielmone, in press). The larvae of *A. t. triguttatum* may also intake water to the environment to extend their longevity, a mechnism known to occur in unfed stages of many tick species (Knülle and Rudolph, 1982).

The difference between the onset of the nymphal season of *A. t. triguttatum* in March-April and the adult one in November could be due to diapause of the engorged nymphs induced by short day-length and ended by long ones (Guglielmone and Moorhouse, 1986b) or temperatures higher than 25°C (Guglielmone, in press). Diapause can act as a major regulator of the seasonality of several species of ticks (Belozerov, 1982) and, probably the seasonal cycle of *A. t. triguttatum* in the area of this study is shaped by nymphal diapause.

The forested area supported a larger tick population than the open one, confirming the observation of Derrick *et al.* (1959) and Mc Carthy (1960) who related the severity of host infestation *A. t. triguttatum* to the time spent by the hosts in shaded areas. This could be a consequence of a diurnal drop-off of all stages of this tick species (Guglielmone, 1984) when kangaroos are usually

resting in the bush (GRANT, 1974). Higher temperature and in turn higher saturation deficit of water in the open pasture than in the forested habitat may also be another factor enhancing the mortality of host-seeking stages of *A. t. triguttatum*. Heavier mortality of *Ixodes ricinus* in open areas than in forested biotopes has been reported (DANIEL *et al.* 1977) whereas SEMTNER *et al.* (1971) and PATRICK and HAIR (1978) found that the habitats with high temperature and low humidity during the day supported only small populations of *Amblyomma americanum* even when hosts were available.

Collaterally to the study on *A. t. triguttatum* a few data were obtained from the ill known *H. bancrofti*. This tick species parasitizes mainly macropods but can attach to cattle and infect them with *Theileria* spp. (RIEK, 1982). Larvae, nymphs and adults of *H. bancrofti* were more abundant on wallabies (*Wallabia bicolor* and *Wallabia rufogrisea*) in February-March, June-July and September-October, respectively (RIEK, 1982). Nevertheless, host seeking stages caught in Durikai State Forest showed a different seasonal pattern, stressing the necessity of additional studies to understand the seasonality of *H. bancrofti*.

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